

Wolff Law Offices, PLLC  
Response To Election/Restriction and Amendment

Appl. Ser. No. 10/657,188

In The Claims:

Please amend claims 19 and 20 as follows:

1. (Previously Presented) A method of fuel control for synchronizing an individual engine cylinder's fuel changes to their respective changes in exhaust gases, including the steps of:  
  
providing a catalyst for reducing exhaust gas emissions;  
  
correlating controlled fuel changes of individual cylinder's injectors to subsequent detected exhaust gas changes, controlled at magnitudes differing from normal operation; and  
  
storing in memory a time delay period based upon a time difference between causing the fuel change and the detected exhaust gas property changes of the individual cylinders.
2. (Original) A method according to claim 1, further comprising the step of:  
  
determining an oxygen sensor time response characteristics for assessing proper operating condition of the oxygen sensor using the time delay period stored in memory.
3. (Previously Presented) A method of individual engine cylinder closed loop fuel control, including the steps of:  
  
providing a catalyst for reducing exhaust gas emissions;  
  
detecting exhaust gases' rich or lean conditions with a switching oxygen sensor;  
  
synchronizing a sampling time period for detecting a change in an oxygen sensor's output condition to an individually selected cylinder's exhaust gases entering the exhaust manifold;

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detecting at least one engine parameter sufficient to determine stable engine operational conditions;

controlling a closed loop fuel control change in the fuel quantity during a first period to all cylinders connected to an exhaust manifold with a common oxygen sensor by using the minimum said quantity to cause sensor cycling between rich and lean conditions;

sampling the oxygen sensor's condition during a second time period when each individual cylinder's gases are entering said exhaust manifold and identifying cylinders resulting in a contrary sensor condition to the respective said closed loop fuel control changes during the first period;

controlling a minimum change in fuel quantity into at least one of the selected individual cylinders with said contrary sensor conditions, using said fuel quantity sufficient to produce a change in the oxygen sensor condition thus differing from the selected individual cylinder's exhaust gases' conditions sampled in the second time period, during a third time period;

determining the minimum change in fuel quantity causing a change in the oxygen sensor condition for each selected individual cylinder having said contrary sensor conditions follow the third time period and storing in memory such minimums for each respective individual cylinder during stoichiometric conditions; and

establishing a learned average fuel quantity offset for each individual cylinder by adjusting all cylinders' offsets such that the minimum said fuel control change necessary for each selected engine operational condition are stored in memory.

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4. (Previously Presented) A method of fuel control for synchronizing individual engine cylinder fuel changes to subsequent changes in exhaust gases' conditions, including the steps of:

providing a catalyst for reducing exhaust gas emissions;

detecting exhaust gases' conditions with an oxygen sensor;

detecting at least one engine parameter sufficient to determine stable exhaust gases' conditions for monitoring during a first time period;

causing a sequence of changes in fuel quantity to at least one selected grouping of cylinders, during a second time period, differing from the fuel quantity in said first time period, so as to produce a change in exhaust gases' air-fuel conditions differing from the exhaust gases' conditions detected during the first time period;

monitor a time period, from a selected reference point, for the time of the first change in said exhaust gases' air-fuel conditions that are caused by said changes in fuel quantity during said second time period; and

storing in memory the monitored time period from the selected reference point.

5. (Original) A method according to claim 4, whereby the oxygen sensor detecting exhaust gases' conditions is a switching type sensor having two discrete output voltage characteristics for conditions richer and leaner than stoichiometric.

6. (Previously Presented) A method of transient engine fuel control compensation to selected individual cylinders, including the steps of: